Reconstructing the evolution of galaxies with cosmic time

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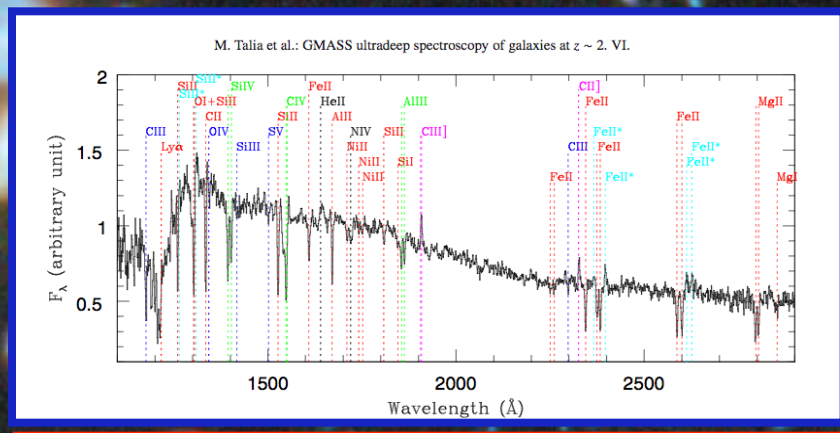
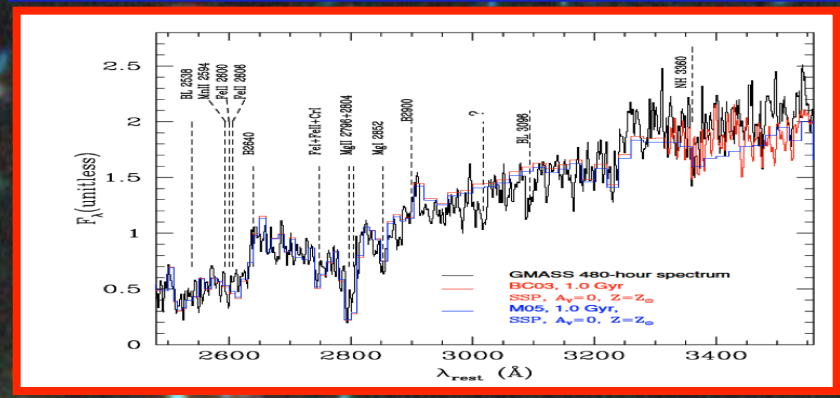




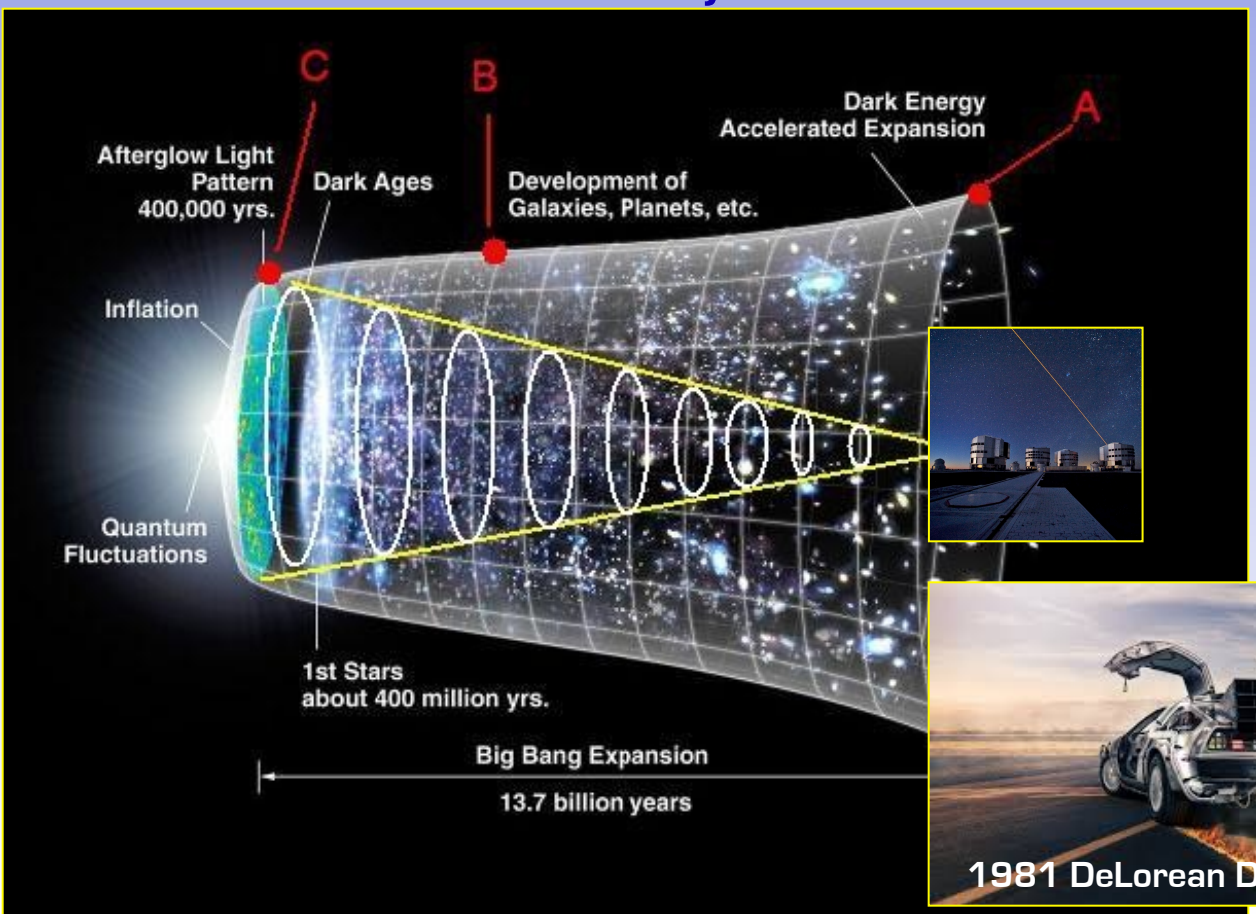
Thesis Day – 10 Dicembre 2018 - Bologna

Reconstructing the evolution of galaxies with cosmic time

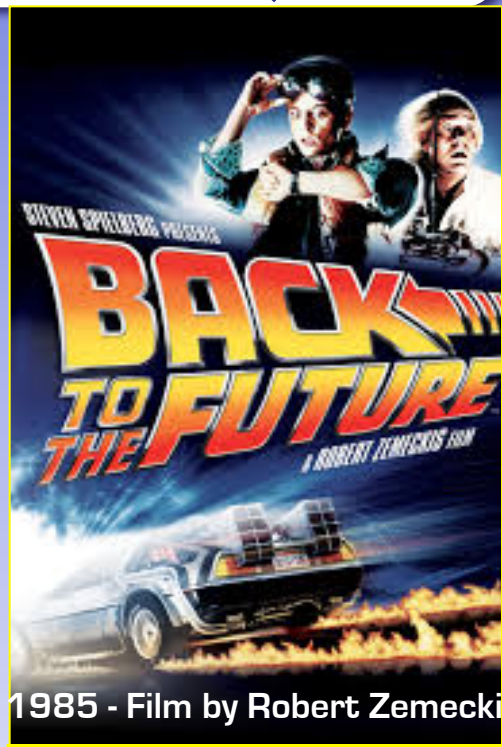
Galaxy Spectroscopic Samples as time machines:

- Lookback time studies;
- Archeological studies;
- Forecasts for future survey.

Key probes to investigate galaxy formation and evolution



1981 DeLorean DMC-12

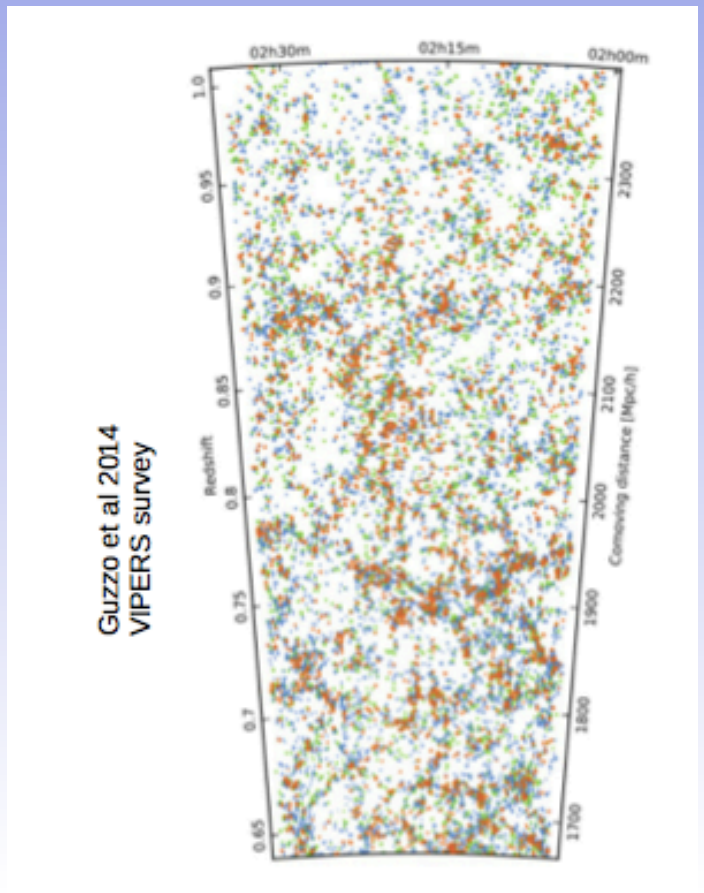


1985 - Film by Robert Zemeckis

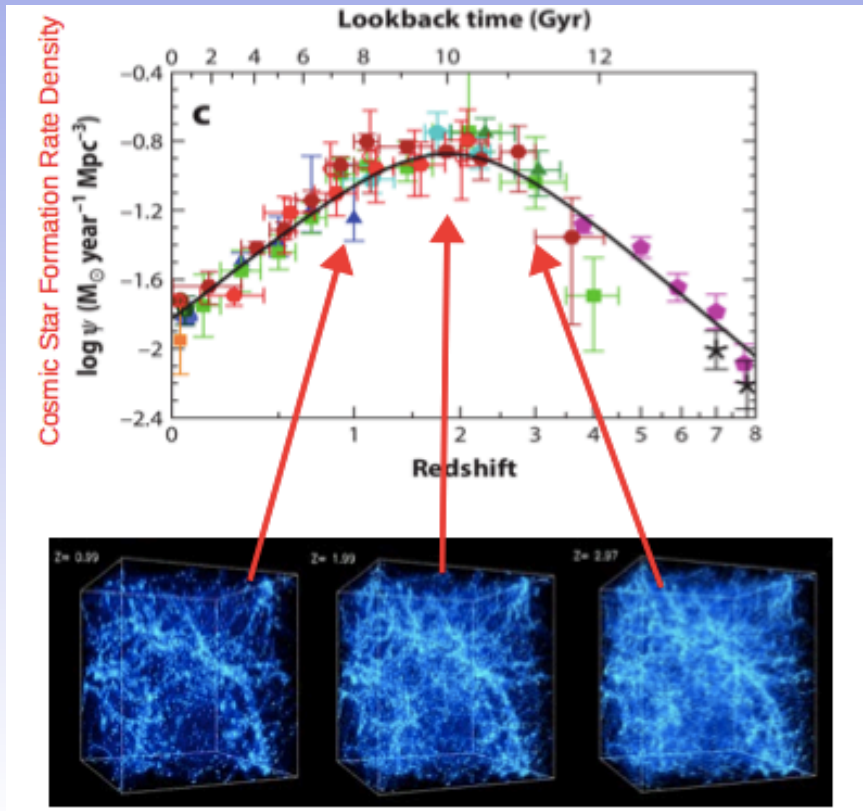
Inferring the physical properties and star formation histories of galaxies through cosmic time

The role of the environment in galaxy evolution

Galaxies that live in dense environments (clusters, groups, filaments ...) are affected by physical processes that can alter their properties (quench star–formation, change shape etc)



Which is the epoch when the role of the environment was more effective?



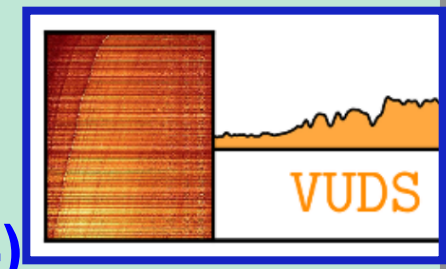
Past, Present, public and future projects

zCOSMOS (20k spectra @ z<1)

GMASS (~200 spectra @ z<1 & z>2)

VIPERS (100k spectra @ 0.5<z<1.2)

VUDS (10k spectra @ z>2)



VANDELS (2k spectra @ 1<z4)

SDSS + BOSS(high-R spectra @ z<0.5)

Lega-C (spectra z~1)

MUSE + MANGA (IFU)

WEAVE+STePs

(high-R spectra @ 0.3<z<0.8)

MOONS (near-IR spectra 0.7<z<2)

Euclid (Halpha emitters 0.9<z<2.3)

Dynamical masses and scaling relation of passive galaxies

Background: *evolution of scaling relations* is poorly constrained at z>1 (e.g. van de Sande+14; Belli+14). ETGs and massive SFGs may lie on the same FP (Bezanson+15)

Aims: derive the evolution of scaling relations of dispersion-dominated galaxies (e.g. ***σvel–M*, Mdyn-M*, FP, mass-FP, size-mass, density-mass***), constraints on ***M/L and IMF***, comparison of ETGs and SFGs, and with models of massive galaxy formation.

How: ***high S/N*** and moderate resolution of **VANDELS** spectra to *measure σvel and estimate dynamical masses of* ***individual and stacked spectra***. ***HST imaging*** will be used for *surface brightness profiles* and structural parameters.

Tools: PPXF, **STARLIGHT**, **GALFIT**

People @ INAF-OABo: L. Pozzetti, M. Bolzonella, O. Cucciati

@ DIFA A. Cimatti, M. Moresco, M. Talia

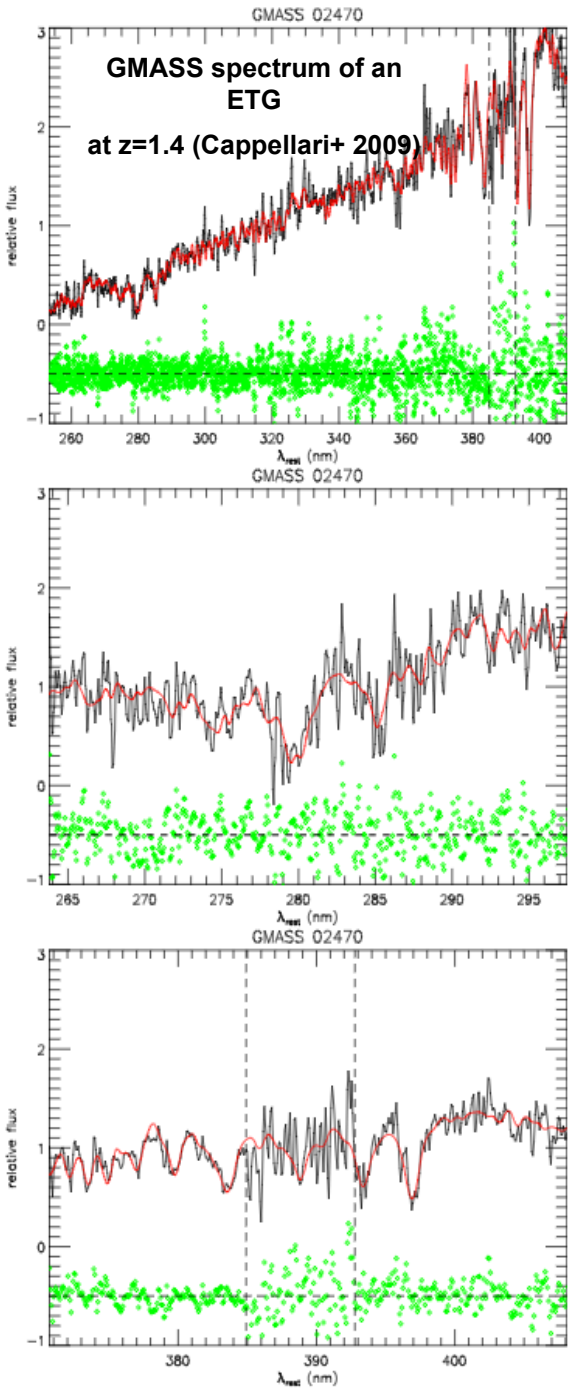
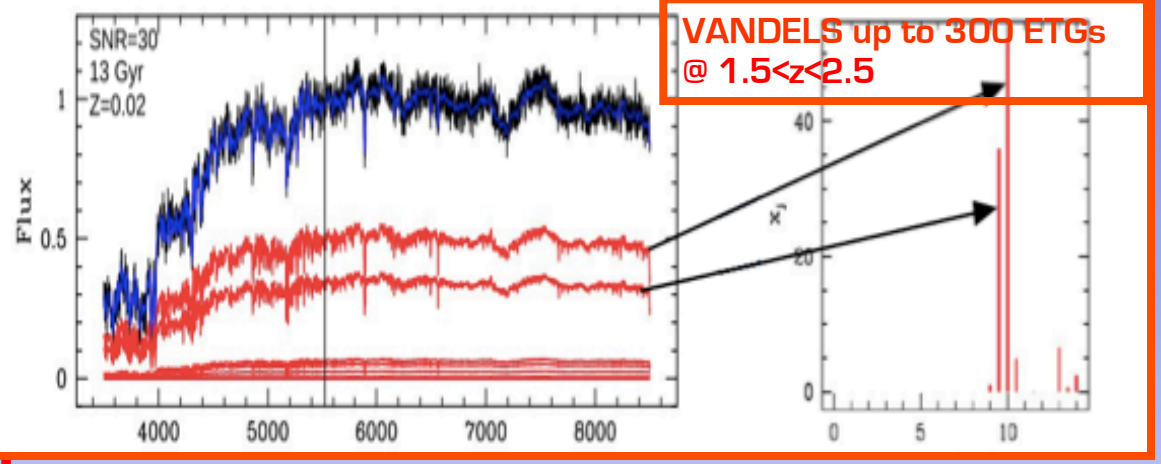
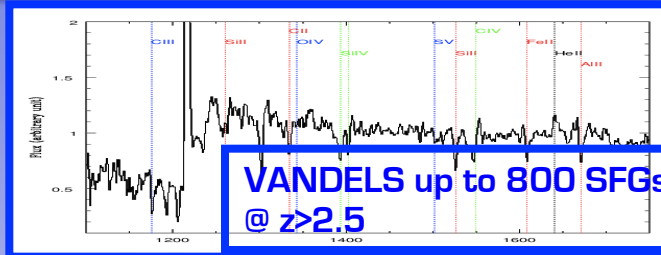


Figure 1. Kinematics extraction for GMASS 2470 ($z \approx 1.4$). The panels show

Spectral fitting decomposition



VANDELS up to 300 ETGs @ 1.5<z<2.5



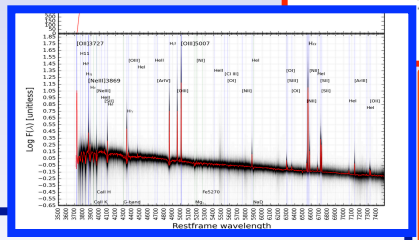
VANDELS up to 800 SFGs @ z>2.5

How: *spectral continuum decomposition*, + absorption and emission lines from single or stacked *high S/N spectra*.

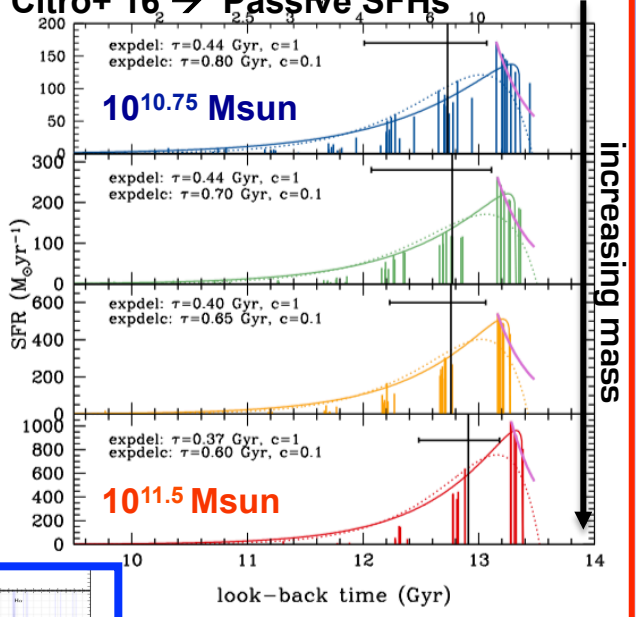
Aim: Derive ***physical properties (age, Z, dust, U, ...) and SFHs*** as a function of cosmic time, galaxy type, environment

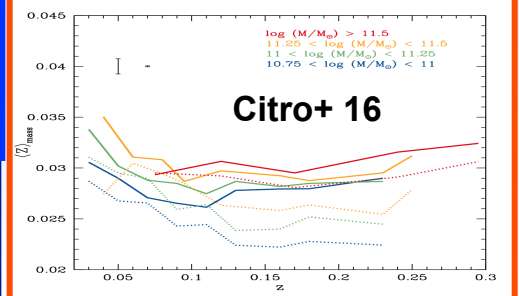
Surveys: **VANDELS (1<z<4) + simulations WEAVE (0.3<z<0.8) + MOONS (z>0.8)**

Tools: **STARLIGHT**, PPXF, **CLOUDY**



Citro+ 16 → Passive SFHs





People involved @ INAF-OABo: L. **Pozzetti**, M. Bolzonella, O. Cucciati

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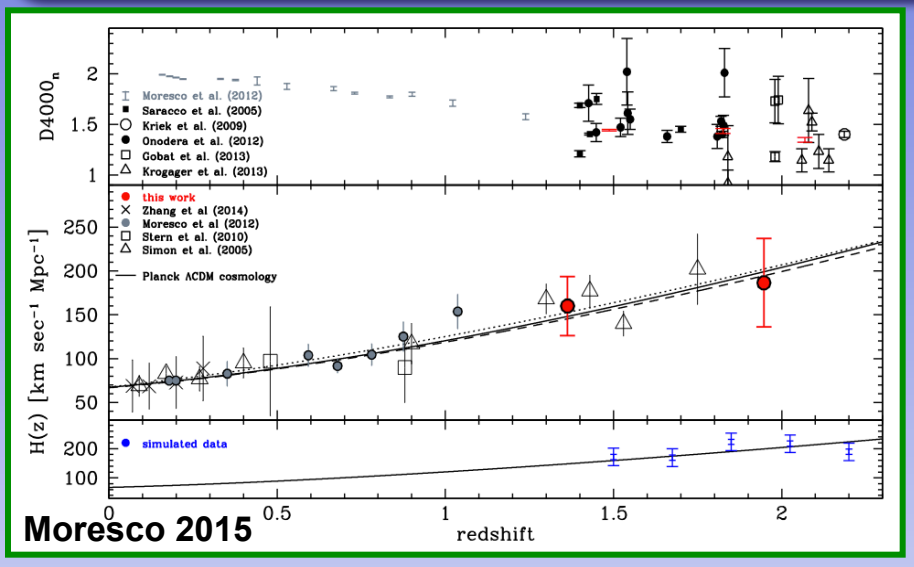
Cosmology with passive galaxies in VANDELS



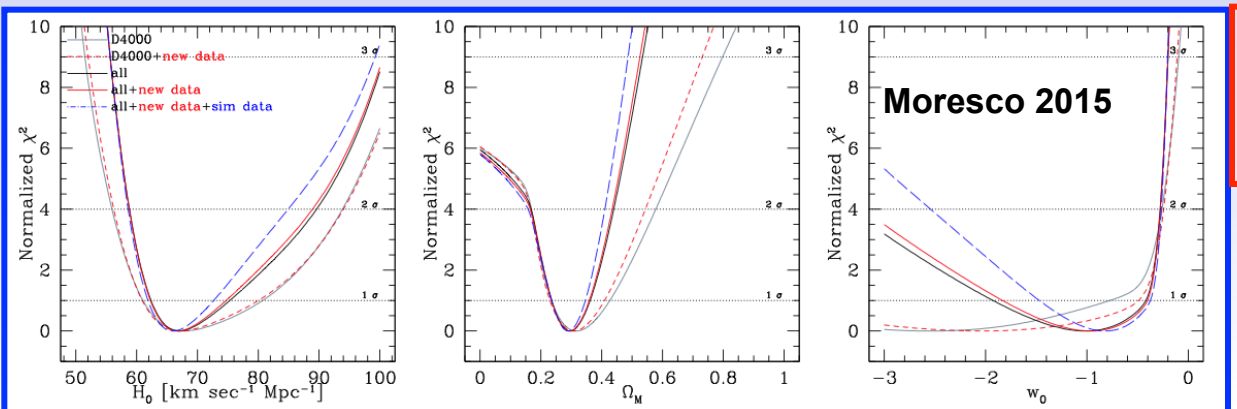
Background: *H(z)* poor constraint at z>1

Aims: possibility of setting ***cosmological contraints*** from the spectroscopic evolution (studying absorption and continuum indices) of passive galaxies

How: using *D4000 and UV indices and breaks* as cosmic chronometers (Moresco +2012, Moresco 2015, Moresco+2016).

Surveys & Tools: **VANDELS** spectra, MCMC

H_0 Ω_m ω_0



- From ~30 to ~300 Massive ($>10^{10.5}$ Msun) Passive galaxies @ 1.5<z<2.5

People involved @ DIFA , M. **Moresco**, A. Cimatti

@ INAF-OASBo: L. Pozzetti

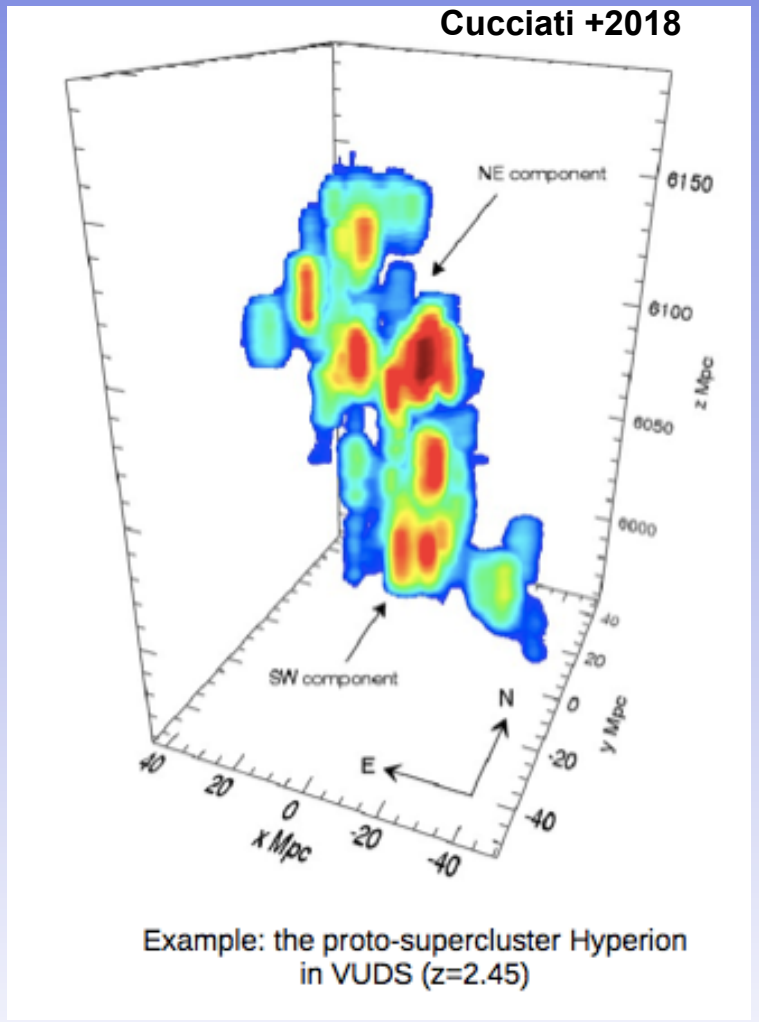
Density field reconstruction and identification of proto-clusters in VANDELS (z>2)

Background: *At z>2 structures are still in formation, and it is easier to catch environmental processes in the moment they are happening.*

Aims: The aim of this project is characterize environment and to perform a systematic search of candidate proto-clusters in **VANDELS**

How: Using photometric and spectroscopic redshifts to derive environment, even at z>2. The Voronoi tessellation is effective for structures in formation, which might have different shapes

Tools: An IDL tool is currently available for density field derivation and detection of proto-cluster candidates



Example: the proto-supercluster Hyperion in VUDS (z=2.45)

People involved @ INAF-OABo: O. Cucciati, M. Bolzonella, L. Pozzetti

@ DIFA A. Cimatti

HIZELS

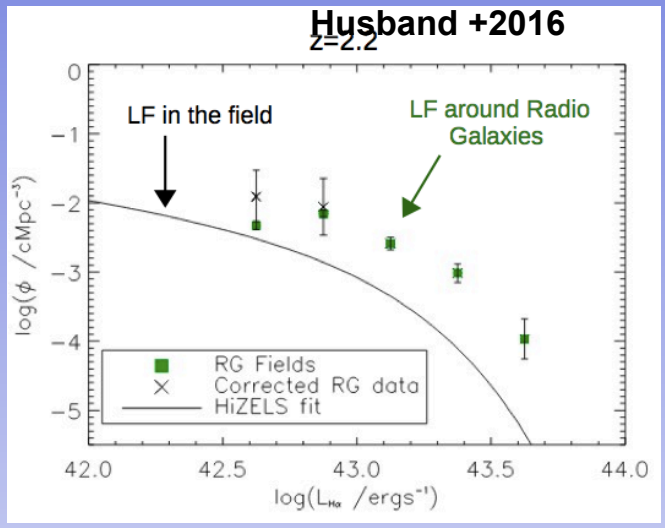
Hα Luminosity Function in different environments

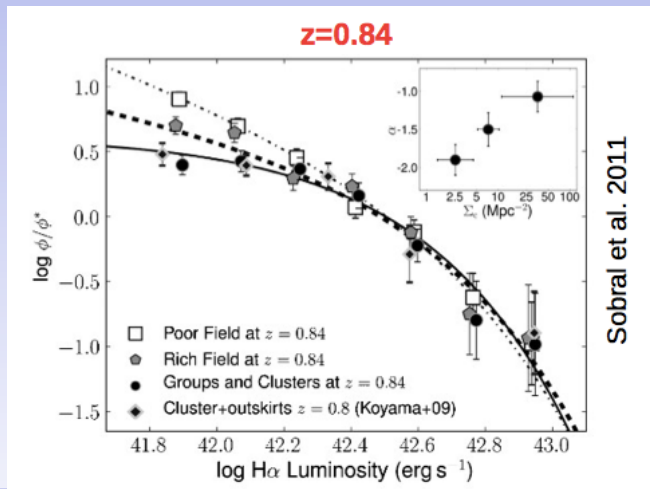
Background: The Hα emission is a tracer of star formation activity. The study of the Hα Luminosity Function (LF) allows us to derive the total Cosmic Star Formation rate Density at any epoch.

Aims: Study of the Hα LF in different environments at z>2, to verify the enhancement of SF activity in high density regions. This analysis will be also used for the forecasts for the **Euclid** surveys.

How: Use of catalogues of Hα emitters (e.g. **HiZELS**) + environment characterization.

Tools: Codes already available for the derive the environment and for the computation of the LF





Other projects based on environment in other surveys are also available

People @ INAF-OABo: **Cucciati**, Pozzetti, Zucca

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